Effect of improved crop production technologies in enhancing sorghum productivity in rainfed areas of Mahbubnagar district in Andhra Pradesh

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Citation : Ravinder Reddy Ch, Reddy BVS, Ashok Alur S, Ashok Kumar A and Sanjana Reddy P, (2007) Effect of improved crop production technologies in enhancing sorghum productivity in rainfed areas of Mahbubnagar district in Andhra Pradesh. Journal of SAT Agricultural Research 5(1).

Mahabubnagar district in Andhra Pradesh state of India is a drought prone area, classified as 'rain shadow area' and receives an average annual rainfall of 587 mm. The district falls under hot moist semi-arid Agro-Ecological Sub Region (AESR) as per National Bureau of Soil Survey and Land Use Planning (NBSS&LUP). Erratic rainfall, frequent dry spells, low soil fertility, inappropriate soil and water management practices causing land degradation, and declining land : man ratio are some of the important problems faced by the farmers in the district. Sorghum (*Sorghum bicolor*) and pearl millet (*Pennisetum glaucum*) are two important and predominant crops grown in the district. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is executing a project on "Enhanced Utilization of Sorghum and Pearl Millet Grains in Poultry Feed Industry to Improve Livelihoods of Small-Scale Farmers in Asia" in coalition with other partners. It is funded by Common Fund for Commodities (CFC) and Food and Agriculture Organization of the United Nations (FAO) (CFC/FIG/32). One of the activities of the project is to enhance sorghum crop productivity and improve livelihood opportunities through improved production technologies using convergence and coalition of institutions.

The strategy adopted was a knowledge-based, bottom-up and participatory approach, which involved close interactions with the project executing agency, coalition partners and farmers. A detailed baseline survey was conducted using participatory rural appraisal (PRA) in each village of the cluster and through structured interviews. The survey was helpful in understanding the constraints in planning the strategies for achieving increased productivity from the farmer's perspective.

Representative soil samples were collected from fifty-two farmers' fields in Uditiyal cluster villages (Soorarum, Chouduru, Kakarjala, Bheemarum, Bandapalli, Uditiyal and Veeranapalli) and were analyzed for macro (NPK) and micro (Zn, S and B) nutrients. The results indicated that all the soils were low in N (85–99 mg kg^{-1} soil), low to medium in available P (5–9.6 mg kg^{-1} soil), medium to high in exchangeable K (92–134 mg kg^{-1} soil) and low in available Zn, S and B. The soil test results along with historical rainfall data enabled us in identifying appropriate interventions to improve yield levels.

Four on-farm demonstrations were conducted in an area of 400 m^2 for each treatment in each of the farmers' fields at Uditiyal village during the rainy season in 2006 to demonstrate the beneficial effects of improved production technologies in sorghum. Two hybrids were tested at different levels of macronutrients (N, P and K) and micronutrients (Zn, S and B) in four farmers' fields. Seven treatments were studied: T1 – Full dose of NPK and micronutrients; T2 – Full dose of NPK; T3 – Half dose of NPK and micronutrients, T4 – Half dose of NPK; T5 – Neither NPK nor micronutrients applied, T6 – Farmers' practice; and T7: local cultivar with farmers' practice.

Improved package of practices was followed that included growing improved cultivars (JKSH 234, JKSH 528) using a seed rate of 8 kg $ha^{-1}$and seed treatment with Thiram (3 g kg^{-1} seed). However, for fertilizer, different levels were studied (full dose: 40 kg N, 20 kg P; and half dose: 20 kg N, 10 kg P). Entire P and 50% of N were applied as a basal dose and the remaining 50% of N as topdressing at 30 days after sowing. Basal application of micronutrients included a mixture of 5 kg borax (0.5 kg B) ha^{-1}, 50 kg zinc sulfate (10 kg Zn) ha^{-1} and 200 kg gypsum (30 kg S) ha^{-1}. Two intercultivations at 20 and 40 days after sowing were done to control weeds. Carbofuran 3G granules were applied at 15–20 days after sowing to protect the crop from shoot fly and other pests. Improved production technology was compared with the farmers' practice (two treatments) in each of the farmers' fields.

Results

The comparison between T1 and T2 treatments and T3 and T4 treatments showed significant differences for grain as well as fodder yields indicating significant influence of micronutrients. When T1 and T3 treatments and T2 and T4 treatments that differed in dosage of NPK were compared, significant differences were observed for grain yield as well as for fodder yield. This indicates that application of the recommended dose of macronutrient fertilizers (N, P and K) significantly increased grain and fodder yields.

The improved production technologies (T1) gave significantly higher yields in all the farmers' fields tested and recorded a mean grain yield of 2.03 t ha^{-1}, which is 222% higher than that obtained with farmers' practice (T7) (0.63 t ha^{-1}) . In addition to increase in grain yield, improved technology also resulted in 2.67 t ha^{-1} more fodder yield over local control (T7).

However, compared to farmers' practices, improved technology resulted in increased mean income of Rs 5025 (US$112) ha^{-1} with a benefit-cost ratio of 2.2. This additional income could substantially benefit small-scale farmers and improve their livelihoods in Uditiyal cluster.

Ramakrishna et al. (2004) reported that application of balanced macronutrients (NPK) and micronutrients (Zn, S and B) significantly increased grain and fodder yields in pearl millet. Similar results were also reported by Joshi (1997). Rajat De and Gautam (1987) reported that with scientific management practices, crop yields could be increased at least three-fold.

The increased grain and fodder yields with improved production practices were due to selection of suitable cultivar, application of balanced nutrients at appropriate time in split doses, and carrying other cultural operations on time. The results from the study clearly bring out the potential benefits of improved production technologies in enhancing sorghum grain and fodder yields and net returns in the dry ecoregions in Mahbubnagar district.

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